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THE LONDON WATER-SUPPLY

The London Water-Supply; its Past, Present, and Future.

By G. Phillips Bevan, F.S.S. With a Map showing the Districts of the Water Companies. (London: E. Stanford, 1884.)

THE London water-supply is so important a question, and at the same time one upon which there prevails so much misapprehension, that the appearance of an impartial, candid, and, in the main, accurate treatise like the one before us must be judged seasonable. A full discussion, indeed, of so many-sided and complicated a subject cannot be expected within the compass of 112 pages. Nor is there, perhaps, any man living who is qualified to give an authoritative deliverance on all the considerations involved,—on the one hand, medical, chemical, and engineering, and on the other hand, financial, legal, ethical, and municipal, if not actually political. These two main branches of the inquiry should be kept substantially distinct. For it is at least conceivable that a water-supply might be found irreproachable in quality and ample in quantity, and yet might be furnished on terms so iniquitous as to call for a sweeping reform. Again, a contaminated water might be dealt out in a manner which at least involved no injustice or oppression.

As a matter of course, we shall discuss Mr. Bevan's pamphlet mainly from the sanitary point of view, though we admit that as a whole it well merits the careful study of the ratepayers of the metropolis.

Our author begins with an account of the ancient supply down to the reign of Charles II. This chapter, like history generally, is mainly a record of errors and oversights. It would seem that whilst as individuals we recommend forethought and prudence, yet as a community we very literally "take no thought for the morrow," and thus drift into positions from which we can escape, if at all, only at great cost.

The second chapter deals with the modern supply. It appears that as far back as 1821-28 there was general dissatisfaction both with "the high-handed and arbitrary character of the rates" and with the quality of the water furnished. One company, we learn, took in its supply from the Thames at the mouth of a main sewer, and served out this liquid to its customers without any process of purification. As a specimen of neglect on the part of Government, we may mention that a Royal Commission was appointed to examine the water-supply as far back as 1828. A Select Committee of the House of Commons was still "considering" the report of the Commissioners just six years afterwards, while the Select Committee of the House of Lords took another six years over the matter, and did not consider it until 1840.

Even in those early days attention was drawn to "the filthy and polluted state of the cisterns and butts into which water is received." This nuisance is a necessary consequence of the intermittent system of water-supply. In addition comes the fact that the cistern is generally placed where it is fully exposed to the sun in summer and to the frost in winter.

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We find next a history of the cholera epidemics, their bearing on the water-supply question, and the evidence which they yielded as to the influence of sewage pollution. This influence, as worked out by Mr. Simon, is most striking. Among the population of 166,906 persons supplied with a fairly good water by the Lambeth Company in 1854, the deaths from cholera were at the rate of 37 to 10,000 living. Among the 268,171 persons supplied by the Southwark and Vauxhall Company with a polluted water, the death-rate from cholera was 130 per 10,000. Now, as the two companies at that time competed with each other, their "mains branching within the same area, often running parallel in the same streets," this case was a truly crucial instance. The observations thus made proved to be of no small value. The water companies introduced a variety of improvements. The intakes were removed further from sources of pollution, and more efficient arrangements for filtration were adopted. In 1856 Professors Hofmann and Blyth were able to announce that the organic matter in the water supplied was nearly one-half less than it had been in 1851. It is to be regretted, however, that the lesson was over-learned, and that fanciful and exaggerated notions concerning "contamination" became fashionable. The dogma—for it is not a demonstrated truth—was put forward that all nitrates present in subsoils and rocks result from the decomposition of animal matter. Hence the presence in a water of such salts was deemed a proof that sewage or kindred matters had at some time gained access to the source in question. To this subject, however, we shall have to return below.

An important step has been the closing of the public wells and pumps in and near London. The water of these wells was not merely found to be grossly polluted, but positive proof was obtained that those who drank it suffered exceptionally from cholera. The popularity of these wells may strike us as remarkable. But we must remember that such water cost the consumer nothing. In addition, as Mr. Bevan points out, "the cisterns of the neighbouring houses were generally foul and the water heated, while the well water came up fresh, cool, and sparkling, from the quantity of carbonic acid contained in it."

Mention is made of the establishment in 1868 of a system of inspection of the water supplied to the metropolis. It is not, however, generally known that all the reports issued prior to the investigations undertaken by Mr. Crookes and by Drs. Odling and Meymott Tidy have been based on the analysis of "a single sample of each company's water, taken on one day only in the course of the month." It is plain that such an examination is not alone "rather of a perfunctory nature," as Mr. Bevan says was the case previous to 1865, but positively misleading. We must agree with Messrs. Crookes, Odling, and Tidy that it is "quite impossible to judge fairly the purity or otherwise of a month's supply by an odd sample taken at random in the manner adopted." Hence we are by no means satisfied that the monthly reports issued by Colonel Sir Francis Bolton are of the "immense practical value" which Mr. Bevan seems to believe.

The third chapter is devoted to the existing water companies—their supplies or feeders, reservoirs, and filter-beds; the statistics of the districts supplied, and, above all, their scale of charges. Into these questions, important

as they are, we cannot here enter. We notice merely Mr. Bevan's argument against the compulsory sale of water by meter. He contends that it would "simply result in the greatly decreased use of the water, very much to the detriment of cleanliness and godliness." Surely this hypothetical objection can count for little when weighed against the illogical rating system, which makes a man liable to pay more for his water-supply because his rent and taxes have been raised, *i.e.* because he is poorer! Mr. Bevan, in concluding this chapter, expresses the hope that "either from the operation of purchase, control, or competition, the water question will soon reach a fair and equitable level to both consumer and supplier."

We come now to the main question: Is the existing water-supply satisfactory in quality? and, granting this point, is it not self-evident that, as Mr. Bevan puts it, "it is impossible that the enormous drain upon the Thames can be kept up without its showing signs of exhaustion." The existing supply must, therefore, be supplemented by some new source. Now, in spite of the alarmist speeches, papers, and letters, some of them by authorities of eminence, we still hold that the waters of the Thames and the Lea are not contaminated in such a manner as to render their use inadmissible. It is perfectly true that the country along the Thames and its tributaries above the points where the water companies take in their supplies is inhabited by a large population, whose drainage, not always purified, finds its way ultimately into the river. Now, the late Royal Rivers Pollution Commission, upon what to us seems very scanty evidence, committed itself to the dogma that, "if a river was once polluted with sewage matter, the water of that river was for ever unfit for dietetic purposes, and no practical distance of flow would render such a river safe."

On the other hand, the Royal Commission on Water-Supply (1869) declare in their report (§ 180) that "the organic compounds dissolved in water appear to be of very unstable constitution and to be very easily decomposed, the great agent in their decomposition being oxygen, and the process being considerably hastened by the motion of the water. This purifying process is not a mere theoretical speculation; we have abundant practical evidence of its real action on the Thames and other rivers."

Further (§ 193), "These analyses of Thames waters made for the Commission (by Drs. Frankland and Odling jointly) are sufficient to show, not only the absence of any increase of objectionable matter in the river from Lechlade to Hampton, but that the variations in quality which commence at Lechlade, after showing several temporary changes in many parts of the river's course, fall at Hampton in general to a point as low as at Lechlade (110 miles up stream), and in one respect, *viz.*, the organic nitrogen, to a point even lower."

One more extract may be permitted (§ 214): "Having carefully considered all the information we have been able to collect, we see no evidence to lead us to believe that the water now supplied by the companies is not generally good and wholesome."

It may be urged that these conclusions being based upon evidence obtained in 1869 may not be strictly applicable at the present day. To this the reply is very simple: the results obtained by Messrs. Crookes, Odling, and Tidy in 1881 and subsequently "are in complete agreement with

those of the Commission on Water-Supply." Further, certain improvements have since been effected which must lessen the contamination of the Thames above Hampton. We need merely refer in passing to the corroboration which the views of the Water Supply Commission have received from the recent analyses and observations of Dr. F. Hulwa on the Oder at Breslau, of Prof. Leeds on the Brandywine and Passiac Rivers at Paterson, Jersey City, and Newark, or of Delalande on the Vesle at Rheims. All these chemists agree that, since rivers have a self-purifying power, this power, if not interfered with by the continuous introduction of pollution along their course, restores them, not indeed to absolute purity, but to a condition fit for all practical purposes. The public are apt to forget that pure water is a mere abstraction, like the lines and points of the mathematician. It has no existence in nature, and were it procurable might prove ill-adapted for domestic and dietetic purposes.

Taking all that has been said into consideration, we think that all judicious men will be slow to abandon the present supplies of water. There is one especial reason against such a change, which, though not of a sanitary nature, cannot in these days be left out of sight. In such a vital matter London must not make itself dependent upon any one source. Let us for a moment suppose that the alarmist succeeds in prevailing upon us to abandon the Thames, the Lea, and the other gathering-grounds in the neighbourhood of London, and that our entire supply is conveyed from Wales or Cumberland by a gigantic aqueduct. Would it be possible to guard all points of such a line, so as to be safe against the outrages which seem now the order of the day? A quantity of nitroglycerine, which a man might carry in a carpet-bag without exciting suspicion, would suffice, if skilfully applied, to cause a breach in some part of the structure. And then? How long it might take to make good such a rupture we cannot estimate. In a railway accident, materials, tools, and workmen can be run along the line to the spot where they are required. An aqueduct would present no such facilities. It may be said that a reservoir might be constructed at the London end of the line of sufficient size to tide us over such a possible calamity, but the size and strength of such a store-tank would have to be enormous, and this in itself would present another element of danger.

But whilst it might thus be perilous to supersede the present supply, an addition to our resources will ultimately become needful. Of course, with Mr. Bevan, we can only hope that the additional supply will be the best procurable. But the author here reminds us that, "however pure may be the water at the outset, no power on earth can prevent careless, wilful, or accidental pollution in some part of its long course." In fact, experience tells us that no water-course, exposed to the air for any distance, will contain less than about 0.06 to 0.07 parts of "albuminoid ammonia" per million. The excellent waters of Manchester and Glasgow—the former collected on the barren and unpeopled moorlands of North Derbyshire, and the latter drawn from Loch Katrine—contain this proportion, and the New River water shows no more! It is, therefore, quite an open question what we should gain by going so far afield.

There is another very grave consideration: the soft

waters with which not a few towns in the North of England are supplied, act upon the leaden service-pipes to such an extent as to become dangerous. It may even be questioned whether an occasional epidemic of fever is not a smaller evil than the continued occurrence of lead-poisoning. The use of iron service-pipes, or of lead thickly lined with tin, is troublesome and expensive. Perhaps sooner or later some unobjectionable material may be found to take the place of lead in the manufacture of water-piping.

A well-known authority on water analysis reminds us that waters from the mountains of Wales, Cumberland, &c., may possibly hold lead and copper in solution, and one has been found to contain appreciable quantities of arsenic. Great care would therefore be necessary in the selection of a supply from such districts.

The hardness of the New River water, of that furnished by the Kent Company, and indeed of the London water-supply in general, has often been complained of, and the softness of the northern waters has been urged in their favour. It is, however, by no means certain that from a sanitary point of view a soft water deserves the preference. Many medical authorities contend that a water of moderate hardness is preferable, for dietetic consumption, to such waters as are supplied to Huddersfield, Leeds, Manchester, &c. It is urged, not without a show of probability that a supply of calcareous salts in drinking-water is especially advantageous in the formation of the bones of young children. Dr. C. Cameron of Dublin, however, maintains that there has been an improvement in the public health of Dublin since the soft water of the Vartry was substituted for the hard water with which that city was formerly supplied. Further inquiry, therefore, is necessary in this direction. It seems to us, however, that there is hardness and hardness. The hardness of water may be due to lime salts or to magnesian compounds. For the latter there is comparatively little need in the human system, and their regular ingestion is found unfavourable to health. But to condemn any water as prejudicial merely on the ground of hardness seems to us rash in the extreme, in view of the high standard of health existing in districts where hard waters only are available.

It has been proposed to increase the London supply by means of a system of artesian wells. Unfortunately, though a single such well may yield a large and continuous supply of water, this quantity cannot be multiplied by sinking similar wells in the neighbourhood, as has been found in the case of the celebrated well of Grenelle. Among the many schemes enumerated by Mr. Bevan, there is one prominent in its singularity. Shafts were to be sunk down to the chalk on each side of the Thames every quarter of a mile. Each such shaft was to have a canal communication with the river between high and low water mark, through which these shafts were to be filled with water. At some distance from each descending shaft another was to be sunk, into which the filtered water would flow as in an inverted siphon, until it rose to the level of the river. The water of deep wells is in general remarkable for its freedom from organic pollution. But this purity probably depends on the slowness of the filtration by which they are supplied.

Our author, after giving the details of a great number of projects, comes to no decided conclusion. He remarks

that one of them will ultimately be adopted for the very good reason that a change of some kind will eventually be necessary. But he judiciously adds, "It need not be looked upon as in any way superseding the arrangements of the present supply."

FLOWERS AND THEIR PEDIGREES

Flowers and their Pedigrees. By Grant Allen. (London: Longmans, Green, and Co., 1883.)

THIS book consists of eight short essays on the evolution and distribution of plants which originally appeared as articles in several of the London magazines, supplemented with an introductory chapter. Two of these essays treat of the reasons for the presence of certain plants in our insular flora, as illustrated by the Hairy Spurge (*Euphorbia pilosa*, L.) and the Mountain Tulip (*Lloydia serotina*, Rchb.). The remainder discuss the evolution of certain types of plants, the examples taken being the daisy, strawberries, cleavers, wheat, the family of Rosaceæ, and the cuckoo-pint. The articles are written in the author's well-known pleasant style, and cannot fail to attract and interest many who have never previously turned their attention to the study of our common weeds.

Mr. Grant Allen has a great horror of a "microscopical critic," which he defines as "a learned and tedious person who goes about the world proclaiming to everybody that you don't know something because you don't happen to mention it." After reading this book, however, one feels tempted to reassure him on this head. For the work contains a considerable number of things which we may venture to state nobody ever knew before. Take, for instance, the text of the fifth essay, that on the origin of wheat: "Wheat ranks by descent as a degenerate and degraded lily"; and again, "While the daisy has gone constantly up and while the goose-grass has fallen but a little after a long course of upward development, the grasses generally have from the very first exhibited a constant and unbroken structural decline." This, we think, will be an entirely new view to the botanical morphologist. On these lines he proceeds to trace the evolution of the wheat-plant, from an imaginary primitive Monocotyledon, and suggests that *Alisma ranunculoides* might represent the earliest petal-bearing type in this line of development, except for the fact that its petals are pinky-white instead of yellow! From this plant he traces the descent of the wind-fertilised rushes, the stamens of which he states hang out pensile to the breeze on long slender filaments. This is certainly not the case: the filaments of the rushes are short and rather broad, and the anthers are usually fixed by the base, and not at all more adapted for wind-fertilisation than those of such a plant as the bog-asphodel, which is regularly fertilised by insects.

From the rushes both the sedges and grasses are derived, but on different diverging lines. The former class of plants Mr. Grant Allen considers to be very degenerate in type, the calyx and petals, which were brightly coloured in the lilies, being reduced to the six small dry bristles which we find in some species of *Scirpus*. He does not explain, however, how it is that some Cyperaceous plants possess seven or eight of these bristles. But the most extraordinary suggestion is that